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1964-11

Box 72

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End # 45214



All labels typed

Collection and Field Note Book

No. 72

(Feb. 22, 1964 - May 3, 1964)

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USAF Operations  
Navigation Chart

Andaman Sea

ONE-K-9

1/1000000

Aeronautical Chart

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AGC-ND 48-11



USAF Operational  
Navigation Chart

Andaman Is.

ONC-K-9

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1964

Italy

1

Feb. 22 - Italian coast north of Rome.

A couple of coastal lagoons, rather rectangular in outline. A definitely volcanic mountain a bit in from the coast.

Higher peaks of Apennines to south strikingly snow-covered.

A large circular lake in from the coast. General landscape drab.

Two more lakes inland. Some of the Apennine peaks are extremely rugged.

One of the lakes is also almost circular. Are they caldera lakes?

From lower altitude, the coastal areas are greenish. A few dark patches of forest or brush, mostly very thin grass. Some thinly brushy hills as we approach Rome.

Somewhat north of Rome an area where the farmhouses are small, white, uniform and uniformly distributed.

Just north of airport they are large and bright red. Rows of trees along many roads and between farms.

The several Italian rivers seen have great plumes of silt out from their mouths.



Ganges just below  
junction with Brahmaputra  
delta or flood-plain pattern  
but very dry.

Feb. 23 - Dacca.

Severe thunderstorm in  
late afternoon.

from p. 3

*Lawsonia inermis*  
*Livistona chinensis* (hook.)  
*Rondeletia odorata*  
*Murraya paniculata* (hook.)  
*Clerodendrum infortunatum*  
*Congea tomentosa*  
*Cynodon dactylon*  
*Tectona grandis*

*Rathyrus odoratus*  
*Phlox*  
*Verbena*  
*Callistephus chinensis*  
*Codiaeum variegatum*  
*Euphorbia pulcherrima*  
*Gliricidia sepium*  
*Previllea robusta*  
*Pitchia chinensis*  
*Salmelia malabarica*  
*Tamarindus indica*  
*Mangifera indica*  
*Albizia lebbek*  
*Ixora coccinea*  
*Bougainvillea cf. glabra*  
*Viola tricolor*  
*Ixora chinensis*  
*Rosa sp.*  
*Jacaranda roseaefolia*  
*Carica papaya*  
*Antrocarpus heterophyllus*  
*Persea americana*  
*Zinnia elegans*  
*Lobularia maritima*  
*Saccharum officinarum*  
*Cassia spectabilis*  
*Dianthus barbata*  
*Lamanea saman*  
*Calendula*  
*Ficus religiosa*  
*F. benghalensis*  
*Delonix regia*  
*Sporoxea fistulosa*  
*Helianthus annuus*



Feb. 24 - road between  
Dacca and Narayanganj

Here the landscape is  
one of polders, mostly fallow  
at this time. In many of  
them clay is being dug for  
brick making. There are  
many brick kilns and  
fields where piles of brick  
are stored. Brick seems to  
be used for everything here,  
even pounded up for concrete  
aggregate and road  
material.

Left Narayanganj  
at just before 6 p.m.  
and went down river.  
After the thickly settled  
port area was passed,  
we passed, first rather  
narrow sloping terraces,  
which are muddy and  
slightly grassy. These  
rapidly expand from a  
few m. wide to several  
hundred m. and become  
very flat, and thinly  
green. ~~several~~ Back of  
this is woody vegetation  
low forest in appearance  
but probably trees around  
dwellings. Then, a short  
distance down, a small in-

channel comes in from each  
side. Then the tidal terraces  
become narrow again and  
the river becomes 1 km or  
more wide. This seems to  
be more in the nature of a  
lake, but rather elongate.

Several sharp thunderstorms  
before and after dark.



Feb. 25 - Lower Cache River, W.  
 Some flooded bars with  
 what appear to be tonneria  
 widely spaced, with tuckers  
 between them. Back of these,  
 emergent bars have Phoenix  
 and perhaps other palms. On  
 slightly higher parts  
 are Arca groves.

Several miles down we  
 skirted a large treeless  
 area protected by an artificial  
 levee. Higher parts is and  
 mostly back of this have  
 abundant coconuts, but  
 with other trees, and dwellings.

In places there is a mud  
 platform ~~with~~ a few  
 surface a few inches above  
 normal high tide. On this  
 Phoenix paludosa is very  
 common. A few Cocos locally,  
 a few Brassia, some other trees,  
 plantings of bananas and  
 a few temporary dwellings.  
 Locally thickets of what  
 appears to be a small bamboo.  
 Considerable areas are  
 bare except for very low thin  
 grass.

Photos of the wooded  
 patches & of firewood boats.

A small break in the levee  
 shows that there are fallow  
 rice fields behind it.

The wooded and settled  
 areas are dominated by  
 palms -

Cocos nucifera

Phoenix paludosa

Arca catechu

Brassia flabellifera

Bananas are abundant.

Some Erythrina and other  
 broad-leaved trees.

Abruptly the landscape  
 changes. Flats lying  
 at just about high tide  
 level are covered by a  
 forest - almost closed to chest  
 swamp forest 20m? high  
 of Heritiera of very even height.  
 Photos

Trunks not very large, 15-20 cm?

Where there has been  
 slumping & where the mud  
 flats are not as high  
 as generally, there are  
 patches of Phragmites and  
 of other grasses, mostly along  
 river margin.

Some grass is found on ground  
 but no way of telling  
 what is away from margin.  
 Down there is an extensive mud flat.



Then we cross to the east bank. There there are open forests on ground that is submerged at high tide. Scattered bush rather than trees.

Back of this extensive flats that may be fallow rice - brown and dry, with many cattle grazing in them.

Slightly higher area has Phoenix, Brassia, and various other trees. Some dwellings.

Generally a narrow bushy strip separates river from extensive rice fields, now between crops.

Large areas of village with palms, bamboo, other trees. Locally there appears to be the remains of an old artificial levee, more broken than not.

Below this there appears to be a narrow strip of very slightly higher ground between the rice fields and the river, doubtless a rudimentary natural levee. This has low tangles of Pandanus, scattered Phoenix and other shrubs & trees. Occasional dwellings with

more vegetation around them.

Then an artificial levee, obviously modern, with a narrow strip of slightly emerged mud flat in front, mostly bare & grassy, but with occasional scattered patches of <sup>and individual</sup> Brassia and Phoenix, a few dwellings on it.

This levee extends for some miles, with the terrace in front of it varying in width and amount of vegetation, until we are in the "Reach" (the Haringata River).

A turn is made to the right and we start up the ~~Sella~~ River.

Immediately the banks are lined to some extent by Nipa.

There is a tendency here for Avicennia to be scattered as emergents in a dense forest of Peritiera minor with some admixture of other species. This continuous layer may



be of varying height, but in any one patch it tends to be uniform. In places the *Avicennia* emergents are lacking, and the *Heritiera* forms a dense layer 9-10 m. tall.

This mosaic has led Chowdhury to a theory of local subsidence of blocks due to weight of vegetation and lack of bearing strength in layers beneath said to be a matter of compaction.

Occasional dead and dying larger trees seem to lend some support to this idea, but lack of any "dumkie forest" appearance is against it.

Much of the uniform young *Heritiera* appears to form a rather narrow belt along the river bank. In places a strip of *Nipa* in front of this, usually not or only scattered.

Along eroding banks an occasional fallen or dead tree, but this seems only to be along banks. In all many such, even very small trees.

A few of oldest trees are covered with epiphytes. Scattered small reddish trees may be *Excoecaria*.

Photos of *Nipa*, *Phragmites*, *Heritiera*.

Entered a small channel where the flora became more mixed. Sella River.

*Heritiera minor*

*Cerbera*

*Rhizophora* (new)

*Avicennia*

*Hibiscus tiliaceus*

*Calamus* sp.

*Nipa fruticans*

*Adrostichum aureum*

*Excoecaria agallocha*

*Phoenix paludosa*

*Acanthus cf. alvifolius*

Along much of this channel there is a strip of much lower forest, quite dense, backed by taller forest (photo). Occasional areas slumped into the stream, with leaning trees. In some places the mature forest comes to the shore and usually is being eroded. In places, esp. where forest is mostly *Heritiera*, erosion exposes a dense mat or platform of roots held up by vertical components in a still-like manner.



Banks where there is a fringe of *Nypa* are very low and muddy. There seem to be no extensive *Nypa* swamps, only strips along the edges.

Locally in the forest there is a definite layer of *Phoenix paludosa*, usually where the forest is rather young and rather sparse.

Frequently one side of a channel is lined with *Nypa*, rarely both. Fairly frequent neither. *Pandanus* is rare always, a very low tangled one.

The general level of the ground here is a few inches above normal high tide.

Rarely a little higher, in *Nypa* areas slightly lower.

One spot seen with a temporary dwelling, two large firewood boats tied up, and around it a thin place in the forest where all large trees are cut out and the small ones left.

Suddenly, where most forest is fairly mature, epiphytes, orchids, become general though not abundant a clump or two on each tree.

Locally *Hibiscus tiliaceus*

is common in edge of forest.

Firewood boats are very common here. This wood, acc. Chowdhury, is for various purposes - fuelwood, pulpwood, construction, matches, etc.

Many species are harvested.

Certainly no interpretation of the vegetation of this area can be very sound without taking into account this continuous removal of wood.

Straight artificial channel leads from

just below Chilla the forest on the east bank has been cleared and rice planted. The west bank, almost up to Munгла, is still wooded.

Munгла is an important port, with a number of fairly large steamers at anchor. Also a great many smaller craft. (Photos - Kod.)

Passer lives from Munгла to Chalna

Cocos, *Phoenix*, bamboos, several other trees, ~~some~~ around dwellings dominate landscape between extensive rice fields. Very slight natural levees along rice fields, being eroded away, with ~~the~~ brush, esp. *Hibiscus tiliaceus*.



These rice fields are very extensive, with brushy levees at intervals and small clumps of dwellings, extend at least several miles from the river, on both sides. Coconuts, Mimus, Phoenix around houses, as well as other trees. This Phoenix is much taller and with larger crown than the Palmyra of the swamp forest. West bank is much more densely wooded, with a ~~few~~ broad levee on which are many dwellings. Same general assortment of trees - some areas. The dwellings are, in general, scarcely visible. Farther there is the same general difference between the west bank, with abundant trees and ~~many~~ many dwellings, and the east bank, with sparse brush <sup>some Pandanus</sup> along the tiny levee. The dwellings are mostly farther inland.

Then an area on the west bank where trees are being cut away - be crossing - still standing but not systems exposed, as silt rots. Then ~~a~~ a stretch with the low ~~few~~ levees almost

far. The two banks almost similar.

At Chalva turned west into a narrow winding channel through extensive rice fields, with small clumps of dwellings, single dwellings, and villages ~~with~~ surrounded by trees - Arecas, Coconuts, (b.w. photos)

Phoenix, Phoenix, Mimus, Hibiscus, tiliaceus, palmyra, and a number of broadleaf trees Samanea? Terminalia catappa, ~~are~~ mostly not identified. A few Bravais. Rice fields protected by low mud levees.

Most houses are thatch roofed mud huts. Occasional brick building.

~~West~~ South bank is almost a continuous village. North bank has bushes, locally trees. Houses here are away from channel banks.

Then both banks more or less bare, for a distance, then for a good distance almost a continuous



village on south bank.

New levee on north.

Then Sunderbans forest again on south bank.

Mainly *Heritiera*. On more recent sediments, a thicket of a bright green small tree with scattered larger *Avicennia*.

The small tree may be ~~*Bruguiera*~~ *Bruguiera cylindrica*? The forest varies from closed to somewhat open.

On other bank a solid band of *Nypa*. Rice fields behind it.

In the forest there is considerable of a sedge and some *Acanthus* on the ground, at least near edge.

Many photos showing undercutting, root platform *Acanthus* larger, etc.

In places the forest becomes open and here may be a dense layer of young *Bruguiera*. That appears to be *Excoecaria* has leaves turning yellow or reddish, becoming bare.

Recently deposited mud on convex side of curves have

thickets of young *Avicennia* some *Bruguiera*. Floping mud banks with sedges. Very little *Nypa*.

*Excoecaria* seems to be very abundant near banks, where forest is lower and more open than back a few tens or hundreds of m.

This may be due to opening by wood cutters. The stature and openness both suggest much cutting of larger trees.

Then large stretches of almost pure *Heritiera*. Locally with some epiphytes.

Entered broad ~~*Libra*~~ *Libra* river. Now there is forest on both sides. Up to here on the left has been forest, on right rice fields.

Dense *Heritiera* forest with little variation except where there is a band of *Nypa* along the shore. Where the shore is low and sloping there is *Nypa*, where there is undercutting, no *Nypa*.



Feb. 26 - Sibsa River - to

On a low shore a dense luxuriant forest of *Sonneratia*. Most of the shore of the broad part of the river is rather high, at least at or above high tide, and is being eroded away, exposing the root systems so that there appear to be stilt roots.

*Excoecaria* and *Bruguiera cylindrica* (?) and probably some *Sonneratia*, as well as a light green tree with white trunks seem to make up this rather low forest.

On right bank the forest is very young and mixed, rather open, with locally a thick stand of *Acrostichum aureum*. *Bruguiera* & *Sonneratia* and probably young *Heritiera* are abundant. *Phoenix* local. *Excoecaria* (?) common. The ground is probably a little below high tide level.

On left bank an extensive stand of *Nipa*. The most seen yet, at one place.

Then on rt. bank a tall ragged, rather open forest of *Sonneratia*.

Entered a narrower channel. On left a rather young

stand of mostly *Heritiera* with occasional much larger *Avicennia*.

Same on right. Then on left an area of low scrub, components not identified, mostly not over 2 m. tall, tangled. Back of it tall scattered *Avicennia*.

On other side young *Heritiera* forest, occasional larger *Avicennia* trees.

Then on left a large cleared area of rice field, between crops (brown). This is many hundreds of acres, protected by a small levee. Rather small *Heritiera* forest on right bank.

Cattle grazing on rice stubble.

On rt. bank the *Heritiera* forest is very young, only a few m tall. Back of it a few hundred m. are taller trees.

This strip of young forest becomes narrower and much smaller. The ground at about high tide level or below. Much *Acrostichum* and a number of shrubs.

A few areas are devoid of any undergrowth, with rather few trees and numerous



stumps - laid by chowdhuri to be areas subsided and trees cut off by "wave action". Nearby areas, equally low have undergrowth and denser forest.

Most of forest along this channel is young *Heritiera* several hundred m. wide, backed by somewhat taller *Heritiera*.

A low stretch seems to be entirely occupied by a belt of dense, rather tall *Avicennia*. Where there is fresh deposition here it is colonized entirely by a thick growth of young *Avicennia* 1-2 m. tall. (photos)

The left bank for this entire distance, is cleared and in rice fields.

Some areas on rt. bank show a scattering of large old *Avicennia* in a thicket of young trees, mostly *Heritiera*. Also some slumping of edges down into channel with trees still standing but dead.

Then forest again on left bank. Rather small *Heritiera*, fairly dense, with, at least along river,

considerable undergrowth, *Acrosticum*, shrubs, young trees, *Phoenix* (local). Considerable *Excoecaria* in most of these forests.

Long stretches of medium size dense forest of *Heritiera* with some admixture of *Excoecaria* and other trees, with considerable undergrowth of *Acrosticum*, *Acanthus*, and some unidentified shrubs, occasional *Nipa*, locally no undergrowth.

Stout conical pneumatophore are entirely too abundant to be accounted for by the occasional *Bruguiera* - must belong to *Heritiera*.

Epiphytes locally common appear to be a lanceolate leaved *Polypodium* and a *Hoya* or *Dichidia*.

Many photos of this (b.w.) end 1964-12 • begin 1964-13.

Entered a much larger river, undoubtedly *Sibira*. Lined on both sides by rather old dense *Heritiera* forest.

Seems that what we have been taking for *Heritiera* is really a mixture of that and *Sonneratia*, with the



latter much more abundant along the shores. The prevalence of thick conical pneumatophores which should indicate Sonneratia suggests this.

Along this river, especially in portions where it narrows there is much evidence of deposition - strips of silt and grassy low banks. (Photos)

In wide parts the banks are low - the forest rather open, large clumps of *Acrostichum* and a large grass or sedge.

A small creek completely lined with *Phoenix paludosa*.

Turned off to right in a smaller channel, with rice cultivation on left. Low bank with much slumping on right, small *Heritiera* forest. Epiphytes common.

After a short distance we doubled back along a channel on the other side of the rice lands (photos Vol. 1, p. 10). On the right bank a very mixed forest, much *Excoecaria*, *Bruguiera*, etc. On a large depositional

area a solid stand of young *Avicennia* 2-5 m tall. Locally predominantly *Heritiera*, *Sonneratia*, more predominantly very mixed locally with a prominent shrub layer of possibly *Cerise* or *Kandelia*, locally a mixed undergrowth of shrubs and *Acrostichum*, patches of a grass-like plant - possibly a sedge or *Sphagnum*.

Where *Cerise* is dominant in understory the larger trees seem to be dying back from tips. Some already dead.

On convex banks a thick fringe of young *Avicennia*.

In most of the forest here *Bruguiera* is quite abundant at least very near the river, probably not so back in forest.

Very locally a low thicket forming pandanus with narrow leads.

Local patches of *Bruguiera* extending well away from river banks.

Then rice on both banks back to Chalna.



From Chalna upstream the landscape is an entirely artificial one, of wide rice fields, enclosed by very low levees, scattered bushes in them, especially along levees. Local village and occasional isolated dwellings appearing as patches of woods. Coconuts, Phoenix, Brassaia, Areca, Musa, Ficus of macrocarpa, Terminalia, ~~and~~ Erythrina, and several other broad-leaf trees are planted around the dwellings. (Photos b. & c. and d.)

Part of the scattered shrubs in the paddy fields are Pandanus.

The rice land here is scarcely above high tide level.

In Chalna trees are abundant, esp. Coconuts, Areca, Ficus religiosa, Mangifera, Lalamella, Musa, and various broad leaf trees, as well as bamboo, some Brassaia, Cedrela, Artocarpus, Litorchidites, Tamarindus.

Paper pulp mill uses 'Gawa' zeta wood from Lumnitzera floating in large rafts in front of mill. Logs from 10 to 20 cm. dia.

Heliconia  
Cissampelos  
Tamarindus

### Plants in Chalna

Portulaca grandiflora  
Alternanthera versicolor  
Helianthus sp.  
Cosmos tinctoria  
Hibiscus cf. rosa-sinensis  
Antirrhinum majus  
Lobularia maritima  
Canna sulphurea  
Celosia argentea  
Rosa sp.  
Gaillardia picta  
Tagetes  
~~Citrus grandis (pomelo)~~  
Muntingia calabura  
Alcea rosea  
Bougainvillea spectabilis  
Clerodendrum fragrans  
Aegle marmelos  
Dahlia variabilis  
Lathyrus odoratus  
Centauria cyanea  
Bauhinia sp. crimson 5 ft  
Murraya paniculata  
Papaver sp.  
Sansevieria roxburghii  
Acalypha hispida  
Codiaeum variegatum  
Chrysanthemum coronarium  
Delphinium ajacis  
Phlox  
Euphorbia pulcherrima  
Quercus indica  
Manihot esculenta (cassava)



*Coccolpovia pulcherrima*  
*Pinus (cinerea)*  
*Tabernaemontana*  
*Raphidophora aurea*  
*Dianthus argophyllus*  
*Musa*  
*Punica granatum*  
*Morone crassicaulis*  
*Plumera rubra*

Feb. 27. Legua River below  
 Chandpur - vast plains  
 not protected by levees -  
 with thin grass, many  
 cattle, a few scattered  
 houses with no trees around  
 them. In distance on left,  
 going upstream, the normal  
 landscape with palms,  
 etc. around dwellings.  
 On right for a distance  
 nothing but low green  
 fields, then dwellings  
 surrounded by banana  
 plants <sup>almost</sup> no trees as far as  
 one can see.

Several fish weirs -  
 bamboo fences with  
 nets, extending across  
 river from both banks  
 leaving an opening in  
 center for ships, the  
 ends of the fence curled  
 back and hooked toward  
 downstream direction.

Above this dwellings again  
 approach the banks  
 and are surrounded by  
 trees and bamboo, and  
 bananas, much as seen  
 yesterday, except that the  
 trees seem to be younger.

No levees here, at all, but  
 a flat terrace. (photo - not)



A few small patches of green rice, mostly fallow. A little stubble here and there. Said to be planted to plots of various crops - pulses, mustard, sesame etc. Rice planted to grow during flood season - floating rice.

This special landscape may be adapted to this flooding. The more established houses are on low mounds, up to 10 ft.

This is at the confluence of the Ganges and Megna.

Now on right is a vast plain ~~is~~ grass-covered, with shelving beaches rather than the vertical banks seen below, and with no houses or human works of any obvious kind whatever. The grass is tall and has some fruiting panicles - appears to be *Imperata* or *Saccharum*, or something similar. It is being gathered and carried in large bundles to small boats tied along the shore. Grass is *Saccharum*, but habit not bunchy as in *S. spontaneum*. Infl. is typically *Saccharum*. Seem to be various other grasses and grasslike plants with

a few  
cocks  
much thinner

it, but not a single woody plant visible. Not a tree to be seen. This is in the angle formed by the Megna with the combined river. Where there is an eroded bank here, the soil profile shows a dark surface layer a few inches thick, sharply separated from a white clay extending down to water level or below.

Above the river coming in from the right the land is a little higher, still not enclosed by levees, very thickly scattered with houses, and with an abundance of trees, esp. *Acacia*, and quite a few *Borassus* & *Phoenix*. Considerable bamboo. The houses are typically on mounds of earth. (photo-taken)

The number of boats on this river is enormous. (photo-taken) Many tiny fishing ships. Larger boats with sails and oars apparently carrying cargo. Lines of floats indicating submerged nets are frequent.

Large groves of *Acacia*. This must be an area of supply for Dacca and other cities.



Chandpur has far less trees than other towns seen, and most of them rather low. Surrounded by a ~~low~~ bank or levee of cobbles & boulders, doubtless imported.

Island or peninsula opposite is even more treeless and desolate. Very low. A few bananas and tallest vegetation. Some sort of vine, trained on trellises, is very prominent.

This island and its dwellings, and perhaps even parts of the town, itself, are completely submerged in flood season.

It seems probable that anywhere here that there are no trees is subject to annual flooding of major importance. The fact that houses and trees are on mounds in this land that lacks levees supports this idea.

On up toward Dacca, on the east bank of the enormously broad delta, there is a broad flat plain with no trees and almost no grass. Some goats and cattle grazing on it. Houses with abundant trees

in the distance, and as we go up the river, closer and closer to shore, until immediately at shore, all on mounds.

Opposite, an island, largely bare except for grass, but with small areas of houses and trees.

Here the trees surrounding the dwellings are not dominantly palms, as down stream, but dominantly mangs and several other broadleaf trees. A few acacia and Phoenix.

On new sediments deposited last year sweet potatoes are grown.

Dwelling areas look like mangs forests. Very few palms. No coconuts.

Area of beautiful Salomella on low bank to east. West bank much higher eroding and with a curious terraced appearance.

Above this on east bank wide open very low area with miscellaneous cultivation in stripes.

A clump of houses and 2 brick mosques are being undermined by erosion and partly falling into the river. Much floating Eichornia.



Large areas here are very low, scarcely above river level. On east bank these are grass covered, on west considerable stretches of bare sand.

Large areas of newly deposited silt, one or 2 years old, already planted to paddy, watered by tide.

Feb. 28 - From Dacca to Madapur

~~Long~~ by car. <sup>low</sup> north over cultivated terrace, with terraced mounds. Rice. Brick airstrip.

Mango trees, salwells, Persians, Phoenix bamboo.

Rice cult. Aug. to Dec.

In low areas along river with winter rice, some other crops.

On better drained soil. Loddungas and roadside marked by jack fruit.

Higher more dissected area, mostly uncultivated, small patches of wood. planted soil (14 mi from Mingapur) coppiced lower spot in rice.

Sal apparently not allowed to reach more than about 8 cm dbh.

On a buried impervious clay. Winding lower channels are in rice. A little of it is winter rice, now green, in lowest spots. High spots red.

Then lower, recent Brahmaputra sediments.

All in winter rice, bright green will be harvested in April or May. Then more dissected higher land - bamboo thickets, rice in low spots.

Then flat land with wheat,



sugar cane, rice etc.

Muzaffer

Flat landscape cult. with  
houses & trees on mounds.

Requires in dry season, jute.  
Wheat rice

Ponds where and more common  
much bamboo, mangroves among  
hollings. Many Salicetella  
color from red to orange. A few  
Musa, Carica, Anacardium, Phoenix.  
Karatis.

Large landscape - flat  
fields now in pulses & wheat.  
then jute harvested in July. Then  
rice.

Tanqail.

Thick gardens near town.  
Mango, bamboo are the common  
trees. Some Albizia lebbek.

Ferried across river. (photo box)

Ponds with Eichhornia

Patches of Solanum.

Open alluvial flat area  
divided into patches. Misc. cult.  
A few Ficus religiosa and F. benghalensis.

Kalibati - Ferry crossing over  
river cut-off, with Eichhornia,  
small porpoises, a long snouted  
one 3-4 ft. long.

Road through all of this  
country is on a high embankment.  
Ditches & ponds along side have  
provided the material.

Rolls of rice straw scattered  
about fields - to be burnt  
for fertility.

In distance or right the low  
scarp of reddish Pleistocene  
terrace above recent Brahmaputra  
sediments.

Area more common.

Terrace scarp (facult scarp!)  
much closer.

Aug 28

Small aqueduct and irriga-  
tion system.

Upper terrace - reddish soil.  
Patches of sal woods, here  
to 20-25 cm dbh. Rather open  
mixed with other trees.  
Have doubtless been selectively  
cut.

Small savanna patches  
Madapur jungle tract,  
near Madapur.

Semi-open, canopy very  
incomplete, trees to 3 dm dbh.  
undergrowth very sparse,  
incl. Randia sp. Bauhinia.

Smiles

Vines abundant, reach fair  
size. Bauhinia, Entada, Mimosa, Pongamia.  
Leaves falling on most trees  
or completely shed. Lying on ground.  
Large termitaria. <sup>Covering ground.</sup>

A species of termite builds  
galleries up the sal trees and



excavated galleries under the mud cover.

The soil is very fine, dense, hard, mottled a few inches down gray to yellowish gray. worm casts pH 7, top soil 6.5 lower top soil (reddish) 5.5.

Nearby patch of savanna grass, mowed short by cattle, scattered spiny large leafed bushes up to 1 m. (some up to 3 m on edge of forest).

Soil very hard, ~~grey~~ yellow-grey turning to reddish.

pH 5.5 - top layer, 5.0 on lower layer.

Depression in near center.

Much of this forest has been recently cut down to almost nothing, being allowed to sprout - (2) sprouts left per stump. about km 23

Weeds near fence

*Amaranthus spinosus*  
*Argemone mexicana*  
*Eichornia crassipes*  
*Cynodon dactylon*  
*Lippia nodiflora*  
*Solanum nigrum*

mp 49 Cereales on Zizyphus  
- sp. 7 m in Mangrove

mp. 38 Exposure of laterite red above, grading to bright red & blue mottling within a few dm, then to blue clay.

N of Targi - Top Phoenix by cutting two intersecting layers well into the center showing a small pin below the vertical intersecting line to constant off the sap. Repeated cutting, alternately on one, then the other side, gives the trunk a curious zigzag appearance. Sap used as syrup or sugar.



Kali typed

Feb. 28 - Kalipati Ferry  
6 mi. n. w. of Dacca, Tangail Distr.  
on banks of silt

45121 *Ranunculus scleratus*  
rare

22 *Croton sparsiflorus*

common roadside weed

23 ~~Pasanta~~ *Clinogyne dichotoma*  
cultivated locally

23a *Alternanthera*

Feb. 28 - 7 mi. w. of Mingapur,  
on steep road embankment

24 ~~occasional~~ *Emilia sonchifolia* W. & A.

occasional on bare soil

25 *Cuscuta reflexa*

parasitic on *Zizyphus*

Feb. 28 - Madapur jungle tract,  
s. w. of Madapur, Tangail Distr.  
in rather open disturbed  
forest on hard clay soil.

26 (*acanth.*) *Lepidagathis incurva*  
occasional var. *acuminata*

27 *Blumea*

occasional

28 (~~leuc.~~) *Ventilago madraspatensis* var. *calyculata* ?  
occasional in understory.

29 *Entada purpurea*  
common

30 ~~*Rivina scandens*~~ *Randia dumetorum*  
rare

erect; petals yellow.

much-branched herb.

much branched from base,  
to 2.5 m. tall; sterile; stems  
said to be used for ~~wickerwork~~ matting.  
prostrate

Tangail Distr.

flowers purple, not  
much exceeding involucre.

stems greenish yellow;  
flowers white, on thickened  
inflorescences, coiled around  
stems of host.

erect; flowers yellowish.

erect; heads yellow.

small tree; flowers greenish.

extensive liana, with tendrils.

scandent shrub; sterile.



- 45131 *Lygodium flexuosum*  
common
- 2 32 *Pilea pentagyna*  
common
- 2 33 *Bridelia retusa*  
common
- 2 34 *Randia?*  
occasional
- 1 35 *Shorea robusta*  
dominant tree in forest
- 2 36 *Randia*  
common
- 2 37 same - in grassy savanna  
very common

- vine climbing in bushes  
tree, to 15 m. tall, sterile.
- small understory tree,  
— up fruit black.  
shrub 2 m. tall.
- tree 15 m. tall; sterile.  
— heavily exploited for poles.  
shrub, 1.5 m. tall; sterile.
- sterile shrub up to 1.5 m. tall  
main branches with large leaves,  
small spiny branches with  
small leaves.



Mar. 5 - Dacca

Common street trees are

*Tectona grandis**Lamanea samar**Tamarindus indica**Ficus religiosa**Glinicidia sepium**Mangifera indica**Annona* sp.*Litchi chinensis**Delonix regia*.

Mar. 6 - Calcutta - Bangladesh

via Boing 707 at side. Sep. 10:20

around Dum Dum Airport rather  
dry cultivated land, small plots,  
partly with hedge-rows.

Villages wooded. Many ponds.

Some large areas without  
houses or hedge-rows. Much

water in distance to south.

scattered villages <sup>photo</sup> more  
water eastward (photo - too)

Then the delta proper (photos

from 10:40). Flying along the

boundary bet. the cleared rice

area, tawny brown at this season,

and the humberland. (photos).

All streams very muddy.

Wooded dwelling areas in rice

fields follow small channels,

(photo - too). Most area of this

pattern, or along channels plus

scattered dwelling, between the

large, <sup>muddy</sup> river channels.

Eastward more scattered houses.

Then less so, and the entire

dwelling pattern is less

dense, and as great many

of what seem to be desiccated

or desiccated pools, pale

against the brown of the

rice fields. Then the

mouths of the great

rivers, a complex pattern

of islands, the ones exposed

to the sea with beaches.

Some striking crescent shape

converge to sea. Most of these

islands are cleared and in rice,

but a few still have areas

of mangroves, apparently

indicating low spots,

relative to tides.

Then open sea. Even this is

muddy. <sup>photo near Telenag</sup>~~Photo~~ Court - estimations

from 8 successively added

beach ridge. Course is

about parallel. Two small

islands. A bit of mangrove

back of beach ridge. Generally

dry, brown landscape.

This tapers off in a long

narrow very sharp acuminat

peninsula, sparsely

wooded in south end, with

deep water between it and



another somewhat  
similar peninsula with  
reefs and a few tiny and  
one small islets stringing  
off to south. Very little beach  
on either of them ~~or~~ <sup>points</sup>  
except on the small islet  
to the southward. Nothing  
visible now along coast  
except water. (Could the  
two peninsulas be St. Martin's?  
No, probably too large.)

11:10

11:12

Another island or projecting  
part of mainland:  
separated from mainland  
by a large estuary. Delta  
pattern on most of the north-west  
part (photos - see below).

~~Then~~ This area all the  
way south is uncultivated  
a very intricate ~~mosaic~~  
mosaic of brown grassland  
with small tidal channels  
and brownish to greenish  
forest, also with channels.

Off shore a ~~small~~ <sup>fairly large</sup> ~~island~~  
fairly large islets, mostly  
grass (or rice). Then to  
south of peninsula several  
smaller ~~and~~ not much  
wooded, islands.

Then a coast built up of  
successive beach ridges, with  
channels and mangrove

wood  
St. Martin's

behind them. Then several  
small deltas <sup>(photos)</sup> and the  
entire very irregular  
coast with an intricate  
mosaic of grassland and  
wood with tidal channels  
(photos). Course a bit inland from  
coast. Little indication of  
settlement or human activity.

11:25

Then much more dense  
forest, very little grass  
except immediately back  
of coast and along some of  
tidal streams farther in.  
Then hills ~~with~~ wood, but  
mostly denuded by shifting  
agriculture and various  
stages of regrowth. The  
country more and more  
hilly as course gets farther  
from coast. Still mostly  
secondary. Some large very  
fine scars, quite extensive.

11:26

11:30

More inland ~~the~~ hills seem  
drier, but esp. south slopes.

Then a large, almost  
completely denuded drainage  
basin, with dry grassland  
with some gallery forest in  
lowlands. Along river  
some slightly greener, but  
mostly extensive brown  
plains, with complex old  
flood plain pattern. (Photos)

11:32



11:35

This is really quite extensive a couple of small muddy lakes. Considerable water in channels, a few ponds, etc. Greenish muddy, & rather clear in some channels. A big river with sand bars. Nawaddy? Much green cultivation in big loops of river. Splits into several distributaries (photo taken) more brown plain with vast low greenish areas with dark water ponds & patches of dark vegetation (visibility not good).

11:39

A large very muddy canal crossing brown plain and course, emptying into a large distributary that follows course in middle distance. More furling of distributaries in distance.

11:42

The one paralleling course furling again and enters a very muddy sea. All the country here is brown rice plain, with apparently almost no dwellings. Some mangrove along shores of mouth of the distributaries. Sea quite muddy but blue channels in distance.

11:56

crossed coast at  $45^\circ$  left of course. Wooded, with a small medium sized short estuary mud branched a bit upstream. Some coastal lowlands, then wooded mountains with apparently very little shifting agriculture. Complex country. Locally rail on a few ridges.

12:02

Middle distance a small complex of erosion and muddy streams. Altitude too great and too much haze to make out details.

12:03

12:04

Shifting agriculture. What appears to be a very straight west facing escarpment crosses course at about  $45^\circ$  at of course.

Lower ground, shifting agriculture, meandering stream with light colored sand bars.

12:07

Visibility poorer & poorer. crossed meandering stream. Apparently rather thin forest. Much haze.

12:11

Descending to airport. Rectangular pattern cut transversally by canals. Scattered dissecting pools. Some of the rectangular plots look as though mechanically farmed.



- 17:23 Docks become more abundant,  
and more so.
- 17:24 Intensely cultivated  
country with ~~the~~ dwelling  
and trees along canals.
- 17:26 Crossed river, with enormous  
ox-bow.  
Intensely cultivated land  
obviously mechanized cult.  
Then ordinary cult. rectangular  
plots. Dwellings surrounded  
by hedgerows along  
canals. Hedgerows pale  
green - bamboo?
- ~~17:27~~ Rice fields largely black-  
burned over stubble?  
Yes, fire seen.
- 17:33 Arrived Bangkok Airport  
(Lab. time)

May 7 Bangkok  
Street trees

*Samanea saman*  
*Terminalia catappa*  
*Cocos nucifera*  
*Casuarina equisetifolia*  
*Delonix regia*  
*Ficus microcarpa*  
*Mangifera indica*



## Plants seen

*Tecoma stans*  
*Cordyline fruticosa*  
*Persea oleander*  
*Chloris inflata*  
*Plumeria obtusifolia*  
*Zizyphus jujuba*  
*Albizia alticola*  
*Heliconia schlegeliana*  
*Manihot esculenta*  
*Musa sapientum*  
*Cleome spinosa*  
*Heliconia sp.*  
*Tournefortia ramosa*  
*Coccoloba egallocha*  
*Muntingia calabura*  
*Cordia alliodora*  
*Adenium*  
*Passiflora gracilis*  
*Croton sulphureus*  
*Azadirachta indica*  
*Rhoeo spathacea*  
*Inga edulis*



Mar 9 - trip by small  
boat through Bangkok  
Klong water very muddy  
*Heliconia liliaceum*

*Monstera adnata*  
*Tamarindus*

Coco

a large broad-leaf floating grass

*Eichhornia*

*Pandanus*

*Canna* (red)

*Heliotropium indicum*

Musa

Bamboo

*Excoecaria agallocha*

*Euphorbia* sp.

~~*Euphorbia*~~

*Euphorbia topera* (in pots)

*Canna* (yellow)

*Peltophorum* cf. *ferugineum*

*Zinnia elegans*

*Pithecolobium dulce*

*Lesbania* sp.

*Sporobolus aquaticus*

*Arca catechu*

*Jac araya*

Mixed with the houses  
are thickets of bamboo  
*Heliconia tiliacul*, *Pandanus*,  
~~*Excoecaria*~~ with backing of Cocos,  
*Sesuvium*, *Ficus benjamina*,  
*Tamarindus*, *Casuarina*,  
or *Borassus*, *Delonix*, *Arca*, *Euphorbia*  
in front, along the water's edge  
masses of grass, *Eichhornia*,  
*Achyranthes* sp., *Pandanus*,  
right in the water.

*Ceciba*

Many potted plants -  
orchids, *Euphorbia*, *Epiphyllum*,  
etc. in houses.

The entire Klong is lined on  
both sides with houses  
and, apparently, temples.  
All nestled in the thickets.

One patch of *Nypa* in  
a small side ditch.

*Coix aquatica*

*Syntherisma triflora*

Thap Anan

Thailand



Mar. 10 - an reconnaissance m.p. 100  
 of Bangkok. left side of  
 Dorrer 28. take off 8:22 a.m. m.  
 rice fields brown to black,  
 stubble burned. Canals lined  
 with dwellings with trees, bamboo  
 none between in this area.  
 Canals very muddy.  
 Low shots with some water  
 or desiccating scattered  
 over field. Scattered area  
 of truck gardens, mostly  
 rice. No seed bed, no growing  
 field at this season. Mostly  
 burned stubble. Scores of  
 water buffaloes. Not all  
 canals ~~have~~ are lined  
 with dwellings. Some  
 Dorassu, some Casuarina  
 (branches trimmed off high up,  
 growing back), mostly bamboo.  
 Some concentration in villages,  
 esp. well east some canals  
 lined with trees with few  
 houses. Vast areas of rice  
 with no dwelling, but major  
 canals. Many fields plowed.  
 Change from bay fields to  
 field with scattered termite  
 mounds with trees.  
 Limestone hills with tangled  
 thickets both on slope and  
 base. Patches of reeds? in  
 flower. Much small

bamboo on slopes. Very  
 soon, degraded forest,  
 open. Tall trees with  
 clear trunks, umbrella tops,  
 large patches of bamboo.  
 Some small flat valley  
 bottoms with brown  
 rice fields. Some small  
 banyan patches on slope,  
 but rather few.  
 Large areas mainly bamboo  
 thicket with scattered  
 trees, large areas open  
 tall forest with closed  
 understory. Bamboo  
 patches are light to  
 yellowish green, scattered  
 trees in forest leafless, but  
 mainly either green or  
 just leafing out.  
 Then good hill dipterocarp  
 forest on strong relief  
 Photos scattered through  
 all of these types.  
 This forest now relatively  
 good but canopy only  
 about 60%.  
 Many patches of  
 grassland or meadow in  
 rolling areas in this  
 forest.  
 Full canopy forest.  
 Fairly large areas



then more disturbed, best trees logged out some clearings. Forest with 50-75% canopy then much better. Very mixed composition. Lianas abundant in canopy.

Patches of bamboo, drying apparently flowering. Then more or less level, rolling area, secondary forest, very tangled with lianas and bamboo. Scattered Lagerstroemia in flower (blue). Forest becoming much drier and almost a quite deciduous on hill tops. There hills are rock. Lower more level areas between are green, tangled. Much slash + burn agriculture, probably unviable for the tangled small forest. Cycle must be very long. Canopy here is continuous but much of it lianas.

Large plateau valley area, mostly continuous forest. Locally deciduous, locally green, mostly semi-deciduous.

Then, where terrain is rough again, forest mostly ~~deciduous~~ evergreen, locally much logged out, tangled.

Then flatter country with deciduous rather open forest, locally cleared. Here hills have green forest, flat rocky areas with open deciduous forest with a more closed understory, result of logging. Then damp flat area, locally rice field, locally area of open wood, locally areas of savanna obviously much burning, dry or deciduous bamboo patches, some very considerable.

This is Kerat Plateau. More and more savanna and shrub savanna. Rice local, in strips and patches.

Appr. Nahon Ratchasing. Very eroded areas between rice. Really abused country. New well here.



Back from Korat.  
Burned over country,  
little left but scrub  
and occasional cult. patches.  
scattered large trees.  
Scattered small rice  
patches and areas of  
rice in lower spots. Then  
a rather considerable area  
of rice and termite mounds.  
Scattered areas of bamboo.  
Mostly rice.

Coconut plantations. Some  
areas of scrubby semi-  
forest, semi-savanna, very  
heavily burned. few trees  
of any size. Rice only  
local. Scattered larger  
trees in rice areas. Few  
on areas of slightly higher  
semi-wooded, semi-cleared  
areas. Large areas of very  
open forest to savanna. Some  
patches of sugar cane.

As country becomes rolling  
forest and savanna mosaic,  
then mostly forest as  
relief gets greater. But  
much shifting agriculture  
Villages. Forest is of very  
open canopy layer because  
of trees left in clearing  
very tangled second story

then better and better  
forest. Then open valley  
~~land~~ with deciduous  
woods, ~~then~~ on slope  
mostly bamboo,  
apparently flowering  
over considerable area,  
both on slopes and on  
fairly level ground.  
Patches of forest, patches  
of clearing. Sachau  
spontaneous. Taken over  
clearings. Many trees  
left in some clearings,  
few in others. Patches of  
slender palms.

Then rougher country  
mixture of patches of  
forest and of bamboo.  
Patches of what appears to  
be ~~Burmese forest~~!

Corypha in forest.

Then more flat valley  
land with deciduous  
forest, some clearing,  
semi-rice. Semi-deciduous,  
rather than deciduous.  
Much Corypha, esp. on  
lower slopes. Patches  
deciduous and evergreen.  
Then rougher country,  
more evergreen forest  
but rather degraded,  
winny. Many clearings



many clearings, since we are following road. Some wet spots. More slender fan palms. Patches of *Saccharum*, a small rice areas. Forest very beaten up. Open to semi-open forest of large trees, result of clearing without removal of large trees.

Mosaic of shifting agriculture, flatter land more completely cleared, some rice, more *Saccharum spontaneum*. Patches of thicket.

Now out of mountains. Areas of scrubby, regenerating *Dipterocarpus*. Areas of rice. Mostly regenerating *Dipterocarpus* forest. Some bamboo. Then more rice, with bamboo. Then open larger forest with *Saccharum*, varying to savanna. More and more savanna. Rice & bamboo. Scattered patches of savanna and forest. Then more of these and less rice.

Then better forest except in low stream valley. Then large areas of savanna to open forest

resulting from logging & grazing. Large areas of open to closed forest, all rather flat ground. Patches of *Saccharum spontaneum*. Some clearings being farmed, but *Saccharum* seems to take over rapidly. Much burning. Then better forest with scattered clearings. *Pterocarpus tinctorius*, almost <sup>all</sup> white crown, very common.

Much of this forest very young and secondary. Then no more clearings but forest very irregular, possibly from logging. Semi-deciduous. Patches open or semi-open, mostly closed or almost so.

Crowns of upper layer separated, but lower layers closed. All of deciduous trees, a sort of them, in emergent layer. Here lianas are in lower layers. No bamboo. *Lagerströmia* here. Lowest layer has ~~many~~ many palms, but no tall ones. This is a ~~sort~~



really vast area of  
unbroken forest, mts  
on horizon except a little  
to left of course. Country  
fairly level to rolling.

More and more deciduous  
as we go along, but  
lower layers still green.  
Country becomes hilly  
forest on hills tends to  
be more evergreen.

This is directly south  
of Karat. Halfway to sea.

Country more hilly  
now, semi-deciduous  
to more or less evergreen  
(on hills). Valleys more  
deciduous.

Mountainous area  
mostly evergreen. Vines  
but large trees. Vines  
in some emergents, but  
mostly in lower layers.

In valleys the deciduous  
trees (*Lagerstroemia*?) are  
leafing out. Hills are  
evergreen, dense canopy.

Valleys - emergent layers  
deciduous, mostly, ~~and~~  
~~the~~ canopy dense,  
green.

On mts. emergent layers  
and canopy green. Many  
*Pterolobium* in flatter land

but now this area is  
partially evergreen.  
Still considerable  
*Lagerstroemia* in emergent  
layer.

Large mts in distance  
to right, very rugged.  
Course ~~is~~ over relatively  
level to rolling country  
varying locally from  
deciduous to apparently  
evergreen.

Now more evergreen,  
few bare trees or recently  
leafed out.

Country now between  
rugged mts. Large  
cleared areas *Laccarium*  
blash - burn.

Limestone range on  
it, partly bare.  
Sharp wooded ridge  
on left. Valley a  
mosaic of clearings,  
regrowth, and some good  
forest. Large areas of  
manioc. Some young  
rubber.

Landscapes now more  
open. Some no. Patches of  
*Macaranga*, and of thicket  
rubber that is fairly well  
grown. Rubber now and  
more common.



Mangrove along stream.  
Then extensive *Sonneratia*  
swamp. Thickets of  
small palm. The ocean

to left small sharp  
hills, covered by thicket  
or poor forest, patches of  
clearing. Large rice  
areas and lagoons back  
of them. Small patches  
of coconut.

Low sharp ridges  
separating

S.E. of Ban Wang

Rice areas, bordered on  
sea side by a broad strip  
of mangrove. Some  
*Melaleuca* swamp at base  
of hills. Mangrove  
lines meandering streams.

*Sonneratia* and *Rhizophora*  
contrast well from air.

*Burquina* dense, conical.

Large flats with no  
vegetation but these bet.  
*Melaleuca* and water.

Mangrove very small  
because cut for firewood.

Rice against foot of  
hills. Nipa in low spots.  
Areas of *Avicennia* - grayish.

Abrupt little hills  
with thickets & bamboo  
some patches with ridges

Beach ridge with  
*Pandanus*, forming a  
continuous strip.

Flooded land, some  
dikes for rice, much of  
this in Nipa, *Bumelia*,  
etc.

Large areas of nipa  
near streams, rice away  
from them.

Large rice area.

High mts. to left

On foot slopes, some  
rubber. Villages with  
trees, *Areca*, mangosteen

orchards, some coconuts,  
all in a small mosaic.

Musa. Rubber is apparently  
planted by farmer in small  
patches. Some pepper.

Rubber on low hills.

More and more rubber  
as foot of mts. is followed  
north.

Then, away from mts.  
a mosaic of rice and forest.  
then forest becomes  
dwellings with bamboo  
and trees.

Large rice area.

Marshes with *Sonneratia*  
& *Rhizophora*.

Large *Melaleuca* swamps.  
Rubber on slightly higher ground



Forest on hills  
rubber & pepper between  
mostly rubber, but  
small patches of pepper.  
Then mixed rubber,  
fruit orchards, thicket,  
pepper, grass, village,  
etc. More and more  
of it rubber, but still  
same mosaic. Bamboo  
thickets and rice mosaic  
near stream.

Logging operation.

Grass, regrowth of  
forest, bananas, manihot,  
rubber, felled forest, mosaic,  
much *Saccharum spontaneum*.  
Low sharp ridge with  
thin woods with lower  
story of bamboo.

Then open land with  
thickets, patches of thicket,  
scattered trees, scattered  
cult. patches. Mosaic of  
rubber, thicket, cult. field.  
Limestone ridge to left.

Many cut & burned patches.  
A few patches of standing  
forest remaining, but  
going fast.

Must have been  
country like the country  
about half way south  
from Kerat. Now being

rapidly converted to fruit  
and rubber.  
Some of it rather too  
sandy.

Scattered tall umbrella  
shaped trees left in clearing.  
Forest on small hills.  
but even this being  
cleared.

Beyond hilly area a large  
tract of rather degraded  
semi-deciduous forest.  
Some clearings. Lower  
layers very wiry.

More and more evergreen  
as we go n.w. Rolling  
land, scattered hills.  
Forest rather continuous  
for some distance. Locally  
more deciduous in emergent  
layer. Very good emergent  
layer generally, crowns  
separated to locally  
touching.

Then hills have  
deciduous forest, <sup>but</sup> valleys  
evergreen to semi-deciduous.

Slender fan palms locally  
common. A small palm  
is very abundant locally  
in lower story - small  
*Spinosus* - possibly a  
*Engeskenia* or a large  
*Calamus*. lfts. not in a plane.



Then large area where clearing is going on very rapidly. slash & burn, but over 60% of land, then more, and more much poor sugar cane in various stages. Stumps still in fields.

Then somewhat better forest locally, then predominantly cleared, planted to sugar and manihot. No forest left, but scattered tall trees.

Patches of bananas and coconuts, mostly manihot and cane. Gradual change to rice in low spots. Mtn still on left (termite savanna).

Mixture of rice & manihot fields. Bamboos along tiny ravines. Still some patches of cane. Village with trees.

Some patches of deciduous wood on slightly higher area. Soil here looks generally gray and sandy.

Bamboos along ravines. Coconuts, bamboos, some mangos, etc around houses.

Extensive open rice area. Then extensive mangrove

and rice swamps, with coconuts, etc. on higher ground. Mangroves mostly small. Mosaic of kinds.

Large river. Extensive rice swamps in meanders.

Then vast rice fields. Local villages and coconut patches along canals. Rice is all stubble now, being grazed by herds of carabao. Apparently not burned here. Ground cracked.

One patch of green rice to left. Many cattle egrets with carabao.

This expanse of rice with either winding or straight canals, partly lined with dwellings, & straw stacks, with bamboos and trees, coconuts & bananas, is characteristic of the Bangkok plain.

Here form an irregular gridiron pattern.

More and more scattered dwellings as we approach airport.

Arrived 11:59.



May 11 - Hong Kong

Hills of mainland are brown at this season, except for small proportion covered by woody vegetation, which is dark green. Grassy slopes are generally brown.

Taiwan - passed it, covered almost completely with clouds, but the central mountain ridge, and one to the north and east of it projected above the clouds. The high central peak was covered with snow, extending considerably down the ridges and slopes. A little snow on the northeast peak.



Labels typed

March 14 - Kilauea, caldera  
floor of Halemauuma Pit  
on lava covered by layers  
of small pumice fragments

45138

X7

*Crocosmia*

locally common in  
madow-like patches of  
vegetation

X2

39

*Peltaria geniculata* (Lam.) Beauv.  
common

X1

40

*Chenopodium ambrosioides* L.  
very local

X3

41

*Rumex giganteus* Ait. ex Maxim.  
locally common

X2

42

*Bidens pilosa* var. *pilosa*  
locally common

X7

43

*Pennisetum ruppellii* Steud.  
locally common

5-49

Mar. 14 - Volcano Observatory  
Kilauea

X5

45

*Lepidium*  
locally common

March 14 - Kilauea,  
upper end of Bird Park Road  
along roadside

X5

46

*Oenothera*  
common

3050'

930 m

much branched at  
base, ~~in~~ forming  
clumps, flowers deep yellow.

leaves erect, glaucous  
on ~~lower~~ surface.

stems spreading,  
slightly ascending,  
strongly aromatic.

much branched  
bush up to 0.7 m tall,  
flowers pale green.  
stems elongate, sprawling,  
heads orange, completely dried.  
dense clumps up to  
1 m. tall, panicles purple.

4090'

1247 m

erect, stems thicker  
toward base, petals white,  
conspicuous

4050'

4050'

1235 m

branched at base, not much  
above, old plants to 1 m. tall;  
flowers bright yellow, with  
slight, rather unpleasant fragrance.



74

1964

Hawaiian Is.

(Hawaii - Hawaii Nat. Park 75

- 45147 *Asplenium adiantum-nigrum* L.  
under bushes, rhizome  
deep in lava cracks
- 48 *Desmodium triflorum* (L.) DC.  
common
- 49 *Hypericum degeneri* Fock.  
common
- 50 *Graphalium*  
locally common
- 51 *Conyza canadensis* var. *missill*  
common
- 52 *Desmodium <sup>intortum (Mill.)</sup> ~~missillatum~~*  
common.
- 53 *Cyperus*  
local
- 54 *Chloris gayana* Kunth  
rare

March 15 - Kilauea,  
National Park Residence Area  
around houses

- 55 *Oenothera*  
probably planted
- 56 *Eschscholzia californica*  
planted

March 15 - Kilauea, just  
above Kilauea Military Camp

- 57 *Lupinus*  
established along road

sterile

forming a thin mat;  
flowers yellow.  
plants pale green

(Kunth) long, flat bright green

(Jacq.) DC. clumps, branched at  
base, stems decumbent  
to ascending. flowers  
dull purple.

3950'

1205m

decumbent branched stem.  
flowers yellow, stigmas 4.  
large much branched  
herb, petals orange,  
paler distally.

4600'

1220m

flowers light blue,  
standard with white  
patch in center.



Mar. 15 Chain of Craters Rd.  
bet. 1 + 2 mi. above Kokoalan Crater.

Transect counting 100 Lehua trees over 9 m tall. of these 73 were dead or had obvious dead parts. Mostly only partially dead. about 10 dead or nearly so. Another 100 tree transect same area had 15 trees affected 5 of them dead or nearly so.

This is in open to semi-open lehua forest. Trees up to 20 m. tall. (4 photos - 6 x 4)

A few small Acacia here. These with Trentepohlia conspicuous on bark.

Along road bet. Kokoalan Crater and Aloi Hot spot. There are usually dead or dying trees in sight at any time.

Aloi Hot spot has so much steam that usually there is almost no visibility beyond a few m. although this shifts a good deal. Drizzly rain is falling intermittently.

Napan Trail -  
Just below Pulu Factory  
An area of young sparse Metrosideros - Now the leaves that were unfolding in Nov. are mature but still the foliage looks sparse. All Lycopodium cernuum ~~stem~~ present at thicket time, ~~is~~ dead at top, at least, but new vigorous sprouts are abundant.

Just below this are many dead fronds of Gleichenia, but vigorous newer, immature to fully mature ~~one~~ ones are abundant.

A bit farther the Machaonia has many dead or partly dead leaves, but also many young healthy ones. Some of it is flowering. Damage to Lehua rapidly becomes more striking - seems more so than I remember from Nov.

Machaonia colpodes shows about as much damage as M. angustifolia. More and more dead Gleichenia fronds, but just above the first



1964

Labels  
typed

Mar. 15 - Chain of Craters  
Rd. just above Kobuklan  
Crater.

In open *Metrosideros* forest.

45158

*Gahnia*

very common

X1 59

*Tricholaena rosea* Nees

rare in open place.

X1 60

*Trentepohlia*

on bark of *Acacia* tree,  
but not seen on  
*Metrosideros*.

Mar. 15 - Chain-of-Craters Road,  
Aloi Hot Spot. near  
Aloi Crater  
on Hot ground with steam  
cracks.

X4 61

*Ageratum conyzoides* L.

occasional

X1 62

*Psilotum nudum* (L.) Beauv.

occasional

X1 63

*Digitaria*

rare

X3 64

*Euphorbia thymifolia* L.

very common

X5 65

*Fimbristylis*

rare

Mar. 15 - west edge of  
Napau Crater

X4 66

*Peperomia*

in gulch running down into  
crater.

(to 4.88)

3650'

1115 m

small tufts.

bright orange color.

3175'

980 m

disks purplish.

almost dead, rhizome  
rotted away.

very prostrate

culms prostrate

2700'

825 m

stems erect, dark red;  
leaves fleshy.



steeper place in the trail about half the fronds are dead, half green.

Arundinaria here is OK.

Beginning here the recovery of Lycopodium is now retarded. There is open mixture of grass, sedges, Lycopodium, Gleichenia, Machaeranthera angustifolia, Nephrolepis, Arundinaria, Polypodium.

The <sup>Andropogon</sup> leaves are mostly dead. Cyperus polystachyos has leaves & inf. dead.

The flat ground at the bottom of the slope shows much less damage to the Gleichenia than the slope itself.

Nephrolepis fruticosa apparently not much injured.

Below the fork in the trail the forest is much taller and for a short distance everything shows much less damage. Some dead part in Lycopodium and Gleichenia little else. Then the Metrosideros shows many leafless branches

and quite a few almost leafless trees. There have been dead bark. Many of them in an area to the left of the trail.

Then a stretch of tall forest showing very little effect.

Then the area with tall lehua and an understory of Libotium, extending to the crater. The tree ferns all have 1-3 very healthy full size fronds.

Lycopodium here shows no sprouts near the crater.

<sup>Polypodium</sup> Epiphyllum - Hymenophyllum, Elaphoglossum ~~reticulatum~~, Linum, Psilotum compl., Grammitis texensis, all dead. Elaphoglossum reticulatum healthy and unaffected, except very near crater, where some fronds dead. Mooses & hepatics dead. Polypodium pettiunculoides healthy.

Coprosma gouldii, Alysicarpus unaffected. Broussaisia putting out



new sprouts from  
dead-looking trunks.  
*Vaccinium calycemum*  
healthy.

In trail *Hypericum*,  
youngster a sterile  
broad-leaved hairy grass  
all abundant & healthy.  
*Saxifraga* healthy but  
less abundant. *Paspalum*  
*obicularis* less abundant  
still, but healthy.

*Isachne distichophylla*  
damaged but starting  
to grow again even the  
ends of the apparently  
dead culms.

On crater edge *Styphelia*  
that looked pretty dead  
is sending out some  
healthy sprouts from some  
of the branches. *Coprosma*  
*enodioides* on edge somewhat  
damaged but recovering well.  
*Rubraea scabra* flowering  
abundantly.

*Cyrtus polystachyos*  
+ *C. brevifolius* damaged  
but well-recovered.

*Lehua* on cliff shows  
only rather new leaves  
but is not much injured.

Well over into forest to  
right most epiphytes

are dead, but small  
plants of *Helaginella*  
*menziesii*, several cm. tall  
are appearing in abundance  
on some tree trunks & on  
ground.

Even over to edge of gulch  
mosses & hepatics are  
all dead, as well as  
most other epiphytes,  
except *Elaphoglossum*.

*Thelypteris stenogram-*  
*mides* is injured ~~as~~ in  
that old fronds are dead  
and edges of pinnae of  
younger ones are dead.

In gulch most but  
not all epiphytic  
growth of bryophytes  
dead. Tree ferns have  
fronds that are partly  
brown but not dead.  
*Helaginella* not dead  
but partly brownish.  
Of seed plants *Isachne*  
shows some injury but  
is recovering.

*Coprosma*, *Gouldia*, etc.  
not flowering but healthy.



On new lava in crater floor not a single sign of new plants. Leaves of *Metrosideros* blown over surface and lodged in depressions in some numbers.

Small *Kipuka* that showed no life in ~~the~~ Nov.

now has seedlings of

- 9 *Erechtites valerianifolia*
- many small *Isachne distachyophylla* 10 cm
- many, tiny some 2-4 cm. *Machaelium angustifolia*
- 1 *Gnaphalium sandwicense*
- 3 *Rubus rooseae*
- 1 *Andropogon virginicus*
- ~~*Eragrostis*~~
- 1 *Conyza bonariensis?*
- 1 *Senecio sylvaticus*
- 4 *Pipturus* (red veined)
- 1 *Cyperus* cf. *polystachyos*
- 1 *invidens* (copp smooth, obtuse, firm lvs. to 1.5 cm. l.)
- 1 *Pluchea odorata*
- many ~~2~~ *Dubautia* cf. *scabra*  
(very tiny, in sheltered spot)

All, except 2 or 3 *Erechtites* are on old pretty soil lying on older lava.

Tiny satellite *Kipukas* just w. of large one.

One *Metrosideros* bush apparently dead but showing a few tiny sprouts at base. Another shows no life at all.

3 *Erechtites* seedlings, no budding 25 cm. tall.

1 *Pluchea odorata*, 10 cm.

many *Machaelium angustifolia* up to 6 cm.

a few very tiny *Hypericum* (?)

In very sheltered places on lava, tiny fern sporophytes and gametophytes.

A few patches with sparse tiny moss plants.

*Kipuka* itself - looks perhaps a bit drier than before, but most plants showing recovery except *Lyso podium cernuum*. No sprouts & living stems seen. *Machaelium* alive but not flowering.

*Vaccinium reticulatum* flowering.

*Dubautia scabra* flowering abundantly.

*Glyphelia* mostly sending out some new sprouts.

Around scorched periphery



on n. side many seedlings  
of *Erechtites valerianifolia*  
1-2 of *S. hirsutifolia*  
1 *Pipturus*  
4-5 *Pluchea*  
many tiny unrecognized  
seedlings & seedlings.

Across floor of crater  
~~at~~ north of *Trichurus*  
is a line of steam  
vents with much  
sulphur crystallized  
on rocks.

at top of cliffs this  
continues across flat  
into an area of sparse  
dwarf *Heliconia*, mostly  
dead or nearly so.  
The *Gleichenia*, *Oxalis*,  
etc. are brown and  
dead in a spotted  
pattern. *Andropogon*  
and *Gleichenia* form a  
dense mass. Clumps of  
*Macraea* are mostly  
still alive. Locally *Gleichenia*  
also, but most of the  
vegetation in a space of  
several acres is dead. It is  
recently enough dead so  
it has not yet disintegrated.  
*Fumaroles* are numerous  
in the area, some of them

producing jets of  
steam that is uncom-  
fortably hot. The  
*Lycopodium* here is  
all dead in the hottest  
areas but in those  
where some green  
vegetation remains  
the older stalks are  
dead but there are  
green new sprouts.  
The gas smells a  
bit sulphurous but  
not strongly so. What  
must have happened  
is that the concentra-  
tion of  $SO_2$  here was  
never as high as it is  
in the most affected areas  
just to the south. Where  
the temperature was  
very high, the roots  
were killed. Where not  
new shoots were  
produced.

On Napau Trail, about 300 m  
below Mahalapuhi Lookout  
very near Mahalapuhi Gate  
is a <sup>small</sup> spot where the air seems  
wain. The *Gleichenia*, here about  
3 m. deep, is dead over an  
area of perhaps 50 sq. m.



March 15 - Napau Crater Trail  
 about half way from  
 Mahalapuhi Crater to Napau  
 in Metrosideros forest

45167 *Coprosma*

common in gully

45168 *Coprosma*

common in forest on flat

March 15 Napau Crater  
 Trail, about 0.75 km  
 above crater.

45169 moss

on bare old lava rock.

March 15 about half way  
 between Mahalapuhi and  
 Napau Crater, on Napau  
 Crater Trail

~~45170 *Lycopodium*~~

in small Metrosideros forest

45170 *Phlegmaria* (= *Haplozia*) *filiformis* (Sw.) det. T. Palmer 8/9/62

rare, epiphytic on tree trunk

45171 *Psilotum complanatum* Sw. det. T. Palmer 8/9/62

occasional, on tree trunks

45172 *Psilotum complanatum* Sw. det. T. Palmer 8/9/62

rare, on mossy tree trunk.

March 16 - Puhi Crater,  
 Chain of Craters Road

45173 *Astelia*

occasional in open  
 Metrosideros forest on lava.

2700' shrub 3 m. tall, sterile.

825m unaffected by sulphur fumes.

shrubs 3 m. tall, sterile;  
 unaffected by sulphur fumes

2884'

860m

2350'

870m

erect

3600'

1097m

large rosette, several  
 dm. long, leaves spirally  
 arranged, 3-ranked; fruit orange, fleshy.



Mar. 15-16 Chain of Craters Rd. Dead trees very few near Crater Rim Rd. becoming more common down Chain of Craters Rd. Many at Puhiiman, some all the way to Makapuhi.

Mar. 15 Napan Crater trail - some dead or injured *Lycopodium* back to and beyond Pulu Factory, but the number becoming less in proportion to total till impossible to distinguish from normal occasional dead shoot.

Pig damage very conspicuous almost everywhere along trail.

At Puhiiman much pig ~~to~~ rooting across road from Crater.

Much *Sporobolus apicatus* here, quite smutty.

Of 3 trees 1 m. or more tall along crater rim in parking overlook, 3 are dead. Others OK.

Mar. 16 - Puhiiman Crater  
Around west side of crater more dead than living *Metrosideros*.

Check on 10 numbered trees looked at Nov. 25, 1963.

#3. Certainly far less than '5 of twigs still leafy. Prob. more nearly  $\frac{1}{10}$ . Leaves more brownish red than green. A few small new sprouts several cm. long, the leaves on these pale yellowish green.

#2. Essentially same as in Nov. but many twigs show up to 5 or even 8 cm. of new growth, this rather pale green.

#4. About as in Nov. but almost all twigs have put out a few cm. of new growth. Galls on leaves very numerous, even some on new growth.

#7 Essentially as in Nov. but most branches have put on new growth, some as much as 10 cm. this tending to be pale and reddish, but not so on all twigs.

#6 About as in Nov. perhaps more leaves reddish or brownish, a few cm. young growth on ~~at~~ many twigs. buds or some other rather large, galls



abundant even on new growth

#5 Essentially as in Nov. but generally a bit less healthy, leaves tending to be splotted with ~~older~~ older ones turning red. Young growth on ~~many~~ twigs but but tending to be red, dwarfed, distorted, galled.

#8. A considerable number of leaves have turned brown, or reddish, esp. on lower and middle branches. Some twigs have young growth up to 5-6 cm. or more long, some of these a bit pale, but mostly healthy. Many branches with well grown flower buds, several inflo. just starting to flower.

#9. All leaves now dead, some still persisting on tree.

#10. Still rather healthy looking, fruiting, one or 2 inflo. still flowering; abundant new growth, rather pale but on upper branches healthy looking, on lower ~~branches~~ branches reddish, on one basal shoot about 3m tall, the young growth very dwarfed, also galled. This shoot has leaves a bit brownish, not as healthy

looking as upper parts of tree. An <sup>erect</sup> shoot from base is reddish-yellow green and has little new growth. Looks unhealthy. Another, smaller, has a rather reddish appearance, but has young growth, this reddish leaves of lower branches of this shoot turning red on lower parts of twigs, and even somewhat on upper parts. Extreme upper twig <sup>one</sup> seem not too healthy, leaves rather small, not much young growth.

No. 1 seems to have had tag stolen. The tree that is most likely it (large one nearest lookout) looks about as described in Nov. Has one of large lower branches completely dead. Most twigs have 3-5 cm. young growth, leaves on this tend to be small, somewhat pale, tendency to be reddish.

Two transects of 100 trees each, roughly parallel, across road from Puhimau Crater perpendicular to road, had of trees to 5 m. or more tall 32 + 28 dead or badly diseased trees.







Mar. 16 - Aloi Hot Area.

List of plants seen in active steaming part.

- ~ *Sadleria cyathoides*
- la *Andropogon virginicus*
- la *Euphorbia thymifolia*
- c *Waltheria indica*
- c, la *Cyperus polystachyos*
- c *Fimbristylis*
- c, la *Nephrrolepis*
- lc *Digitaria*
- c *Saccilepis contracta*
- c, lc *Ageratum conyzoides*
- c *Psilotum nudum*
- o *Vernonia cinerea*
- lc *Pityrogramma calomelanos*
- o *Gleichenia linearis*
- c *Arundina*
- la *Gleichenia linearis*  
var. *tormentosa*
- c *Metrosideros collina*
- lc *Paspalum orbiculare*
- o *Euphorbia hirta*
- la *Claphoglossum reticulatum*
- o *Psidium guajava*
- la *Styphelia tameaensis*
- lc *Psidium cattleianum*
- o *Stachytarpheta dichotoma*
- ~ *Conyza canadensis* var. *pauilla*
- o *Euphea carthagenensis*
- o *Lycopodium complanatum*
- la, *Sphenomenis*
- ~ *Pteris*

- ~~*Psidium guajava*~~
- ~ *Spathoglottis plicata*
- o *Machaelina angustifolia* (per.)
- ~ *Grapphalium purpureum*?

Much of ground bare or with scattered fimbri-stylis + Cyperus. Around steam vents *Euphorbia thymifolia* tends to be abundant, except the hottest ones, which have no plants close to them. *Sphenomenis* is abundant near some vents, but always very dwarfed.

Patches of *Gleichenia* mostly partly dead, except in peripheral areas.

*Metrosideros* 1-2 m tall, mostly dead or partly dead. Other shrubs only in peripheral areas.

*Lycopodium complanatum*, when found, although tending to be dwarfed and sterile, shows no tendency to be killed, as by sulphur fumes.

The hot area has obviously been extended recently, as there are areas of well developed vegetation that are cooked and dead, esp. along some long recently opened cracks on right (south) side of area.



Lammours checked temperatures and found  $83^{\circ}$  -  $86^{\circ}\text{C}$  in two vents. Soil almost as hot immediately adjacent.

*Cladonia* cf. *randiferina* locally abundant in otherwise bare zone. Basal parts appear cooked in some places.

The central areas are largely bare, or with very depauperate vegetation. Peripherally ~~that~~ are large patches of *Gleichenia*, *Nephrolepis*, clumps of *Machaeranthera*, *Psidium cattleianum* etc. Around new vents this may be brown and dead or mostly so. Near the steam vent *Euphorbia thymifolia* and *Sphenocleis* are locally abundant. *Fimbristylis*, *Cyperus*, *Sacciolepis*, *Digitaria*, *Vernonia*, *Ageratum*, *Conyza*, *Cuphea*, *Paspalum* tend to be pioneers in bare areas.



1964

March 16 - Aloi Hot Area  
Chain of Craters Road  
in open ground, hot  
from numerous steam  
cracks and fumaroles

45174 *Saccilepis contracta* (W. A.) Hitchc.  
common

X3 75 *Waltheria indica* L.  
common

X2 76 *Pteris*  
rare, near fumarole

X3 77 *Cladonia*  
locally abundant

X3 78 *Cladonia*  
very local

X1 79 (alga) *Stigonema*  
abundant on bare & areas

X2 80 *Nephrolepis hirsutula* Forst. f.  
abundant

X2 81 *Paspalum orbiculare*  
common locally

X1 82 *Phenomenis chinensis* Maxon ex Kuhn  
abundant locally

3175'

980m

prostrate shrub, over  
1 m. long; flowers yellow.

fronds erect

culms erect or ascending.

all seen were dwarfed.



March 17 - Hayward

Teratological *Calendula*  
 Peduncle conspicuously  
 grooved on one side, the  
 groove extending up  
 between sections of  
 the involucre for about  
 1 cm. The groove at the  
 point shallow and almost  
 1 cm wide, with the  
 missing segment of the  
 involucre on top of it. At  
 one side of this groove at  
 the point of insertion of  
 involucre bracts a secondary  
 peduncle about 5 cm long  
 with 3 bracts about 5 mm  
 below involucre of small  
 secondary head. This head  
 much smaller than normal  
 but otherwise normal  
 in appearance and flowering.  
 The primary head has  
 many ligules but far  
 fewer than normal heads.  
 Coming from the receptacle,  
 interspersed among the  
 florets are 11 secondary  
 peduncles, from about 5 mm  
 to 3 cm long, each bearing 1 to  
 3 small heads, these

on the one with 3 heads  
 arranged in a scapoid  
 cyme, the successive heads  
 smaller. When 2 heads  
 one smaller than the other  
 also. One or two largest  
 show a few ligules,  
 the ligules in these  
 as well as in the subheads  
 obviously at anthesis  
 successively. The small  
 heads mostly have one  
 to 3 leaf-like bracts ~~at~~  
~~the~~ peduncles below  
 the heads, these at times  
 with ~~the~~ a single floret  
 in their axils. On the  
 main peduncle at  
 the base of the side of  
 the extension of the groove  
 through the involucre  
 several axillary achenes  
 in axils of leaf-like bracts,  
 one achene up to about 15 mm  
 l, strongly incurved.  
 Each secondary head in axil  
 of a leaflike bract, even  
 in middle of receptacle.  
 Also each floret on receptacle  
 and each rudimentary achene  
 in axil of a small leaflike  
 bract.



1964

air trip 17. to Wash. left 9:25

Mar. 19 - San Joaquin delta  
at and s. of head of Suisun  
Bay. River channels  
have been and are being  
straightened, but  
there still exist some  
fairly large meanders  
and oxbows. In these  
and even along some  
much smaller meandering  
channels there are still  
patches of uncultivated  
land. This is at least  
seasonally marshy. It  
should be looked at,  
while it still exists.

~~High~~ Reservoirs show  
serious draw-down, for  
this time of year.

High Sierra has  
considerable snow, but  
for this part of year rather  
scanty. Broad high  
area, normally snowy,  
seems to be of large  
scrapped granite. Patches  
of rather sparse forest,  
but a great part of land  
is really bare.

Eastward there is better  
forest in some of the deeper  
valleys and even higher  
slopes draining to east.

Passed directly over Mono  
Lake - shores seem to be  
salt-encrusted. To east  
is a large desert area  
with what appears to be  
concentric ancient shore lines  
up a substantial distance  
from present shore.

Slopes gradually  
up into a vast  
area of hills with open  
juniper - juniper wood.

Extends a considerable  
distance to east before  
there is evidence of  
agriculture and mining.  
About 1 road through it  
for small basins.

~~Course~~ Course follows a highway.  
North of this a fair  
sized complex area of desert  
hills. However, very soon a  
n.s. highway comes in from  
north, then in from south.  
Hwy crosses vast all-fan  
at base of a desert mountain  
complex. Internally this seems  
to have little disturbance -  
a small dry lake inside.

Then an enormous desert  
flat, but cut ~~by~~ by many  
roads. A small town, with  
an airfield - Tonopah. E of  
this a strip of active dunes.



Then a ~~great~~ desert mt. complex with capped buttes. Then a desert valley & more, higher mts. Then a great flat - one road across it. Then a high peak with some forest and thin snow, and some more almost as high. Large flat - one road. Complex of low mts. Then large roadless desert area flat and locally with some hills, both north and south of straight highway.

Then a much larger mountain mass with considerable open forest and thin snow. This is a great area - some roads, part of a n.e. trending range, getting higher and more snowy. Valley s.e. of it has a main road and some smaller ones. S.e. of this is a very large area of low desert hills, mts. & flats. Then a river, meandering with patches of water, a small clock dam, etc.

on road along it, but two roads in desert S. of it.

Area of medium mts. surrounding a dry basin. a road across n.e. end of basin.

Next valley has a couple of roads, but is mostly undisturbed. Then small mts. with traces of snow, very thin forest.

Then a main n.e. road, a little agriculture. Large desert fans and a snowy mt. mass with extensive forest.

3 parallel snowy ranges in distance to north.

The mass along course the most extensive so far e. of Sierras. Bad visibility.

10:35

10:40

A large basin surrounded on n.w. & s.e. by ranges with some snow. scarcely any roads. Then a very large desert basin but with a number of roads.

Then a n.e. s.w. mt. range with some snow, snowy ravine extending down to s.e. Large valley with many



roads, rail road. small  
meandering stream, all  
10:37 mil s.w. then clouds.  
Through clouds, a great  
snowy upland.

10:44

A large rather colored  
desert basin, with little  
evidence of roads but  
much of erosion. Mostly  
cloud-covered.

10:54

Extensive desert basin  
with a few roads.  
meandering stream bed  
with some vegetation  
nearby. Some irregular  
mesas and sandstone  
canyon country (some of  
these a large river with  
water, a railroad or highway  
following it.)

10:59

Dry agricultural country,  
a large river or highway.

11:04

Denver.



Mantley - Great Falls

Down stream from the ~~they have cut~~ place where the sewer crosses the swamp they have cut a channel, parallel to the old stream channel that runs down past the old quarry. This ditch cuts through the swampy tulip forest, it is about 12 inches below the ground surface, so that the water table is being lowered.

A 60 foot swath has been cut clear along the road, and across the swamp.

Near the embankment where the sewer crosses is a low straight ridge covered by a thick growth of *Hypericum* *obscureum*. Looks artificial but has an aged tulip tree on it. A part of embankment.

April 15 - Bull Run found small colony of *Erythronium americanum* on flood plain

perhaps 100 fls. petals yellow, amicusulate at base, sepals not, both st. marked with maroon near base. stamens all yellow, 3 slightly shorter and smaller, but irregularly so. Colony uniform (45183)

On same small flood plain, but away from river bank another, smaller colony of 30-40 plants, similar but all stamens maroon somewhat more differentiated in length. (45184)

On the steep slope above both clones are present

stamens yellow 31-1-13-6-2-3

stamens maroon 30-1-1-1-10-5-20-18

but here there may be several clones involved, as some with maroon stamens have maroon blotches at bases of sepals + petals. Some of both have larger and much more differentiated stamens. One clone has different shaped perianth - ovate acute (45186) others mixed (45185)



1964

Apr. 15 - along west bank of  
Bull Run at Leonard  
~~on flood~~

45183

*Erythronium americanum*  
locally plentiful ~~on~~ on  
flood plain

s. 1

s. 1

84

*Erythronium americanum*  
locally common on flood plain

s. 1

85

*Erythronium americanum*  
common on steep slope  
above flood plain

s. 1

86

*Erythronium americanum*  
very local on steep  
slope above flood plain  
(with # 45185)

Apr. 15 Bull Run, west bank,  
where Rt. 66 (Interstate) crosses  
flat wet area in  
thin woods.

s. 2

87

*Erythronium americanum*  
local in

s. 1

88

*Hedysotis corymbosa* (L.)  
local along old road in

s. 2

89

*Erythronium americanum*  
local in

leaves mottled, flowers yellow,  
slightly marked with  
maroon in center, anthers yellow.

leaves mottled, flowers  
yellow, slightly marked  
with maroon in center,  
anthers maroon.

mixed clones, more or  
less maroon at bases of  
perianth parts, anthers all  
yellow or all maroon.

perianth parts ovate-  
lanceolate, anthers

perianth old-rose without,  
anthers deep maroon.  
limb of corolla lavender,  
eye yellow.

perianth old-rose without  
anthers yellow.



April 15 - west side of  
Bull Run just where  
Interstate Rt. 66 crosses  
Wet flat, second  
growth woods.

*Erythronium* common  
but not abundant.  
2 clones, but not growing  
together, one with maroon  
stamens (45187) the  
other with yellow.  
neither strongly  
differentiated.

*Dentaria laciniata*  
abundant.

*Cystopteris fragilis*  
in patches, sterile.

In flower were

*Claytonia virginiana*

*Dicentra eximia*

*Dicentra cucullaria*

*Dicentra spectabilis*? (on cliffs)

*Corydalis flavida*

*Nepeta hatterasensis*

*Viola roemeriana*

various stemless purple & white *Viola*

a smooth stemmed yellow *Viola*

*Lindera benzoin*

*Cercis canadensis* (just opening)

*Taraxacum vulgare*

*Arabis* cf. *laevigata*

*Lonicera canadensis* (almost past)

April 24 - C & O Canal between  
Paw Paw and Little Orleans.  
Except for tunnel and  
cut through mountain  
at Paw Paw the canal  
runs along the <sup>outer</sup> ~~inner~~  
edge of the flood plain of  
the Potomac, at the foot of  
the shaly bluffs and  
slopes of the Appalachians  
where the river cuts  
through them.

The forests shown on the  
flood plain are poor  
second-growth deciduous  
bottom-land forest,  
mostly rather  
recently abandoned  
from cultivation.

*Amelanchier* cf. *arbutifolia*  
is very common, in full  
bloom. *Acer negundo* is  
also in bloom. No trees  
are very far along in  
leafing out.

Great masses of *Mertensia*  
on alluvial land make  
a wonderful show. An  
occasional plant is pink.

*Erythronium* locally  
abundant but not a  
single one in bloom.

*Alliaria* common the whole  
distance, young buds only.



On the bluffs the forest is largely pine (long. *P. strobus*, *P. echinata*) some *Juniperus virginiana*. Lower slopes largely deciduous.

*Cornus florida* is almost absent along this stretch, one or two plants seen, not yet out.

One patch of *Rhus canadensis* near tunnel.

On steeper slopes *Acer nigrum* s.l. is common, in conspicuous flower the flowers pendent, bright pale yellow.

April 26 - 2 mi. from Stony Point  
Albemarle Co.

Paschal Preserch

Mixed second-growth hardwoods at upper end

*Ostrya virginiana* (fl.)

*Quercus alba*

*Liriodendron*

*Carpinus caroliniana*

*Acer rubrum*

*Cornus florida*

*Pinus echinata*

*Pinus strobus*

*Podophyllum peltatum* (fl.)

*Asplenium bogotense*

*Tipularia discolor*

*Violaria perfoliata* (fl.)

*Viburnum acerifolium*

*Lonicera glauca*

*Rhus toxicodendron*

*Allium vineale*

*Galium triflorum*

*Amelanchier*

*Lonicera japonica*

*Prunella vulgaris*

*Viola* (fl.)

*Galium oblongifolium*

*Kalmia latifolia*

*Corylus* (hairs)

*Hedysotis caerulea* (fl.)

*Danthonia spicata*

*Chimaphila maculata*

*Polystichum acrostichoides*

*Stellaria pubera* (fl.)



*Cercis canadensis* (fl.)  
*Lindera benzoin*  
*Galium aparine*  
*Asplenium platyneuron*  
*Ranunculus abortivus* (fl.)  
*Cimicifuga racemosa*  
*Botrychium virginicum*  
*Oenothera sensitiva*  
*Cynoglossum virginicum*  
*Dentaria laciniata* (fl.)  
*Polygonatum biflorum*  
*Antennaria parlinii* (fl.)  
*Fragaria virginiana* (fl.)  
*Euonymus*  
*Pyrola rot. var. asner*  
*Vaccinium vacillans*  
*Lycopodium complanatum*  
*Alnus serrulata*  
*Belamcanda*  
*Pinus virginiana*  
*Sassafras albidum*  
*Godoliers pubescens*  
*Senecio aureus* (fl.)  
*Smilax rotundifolia*  
*Orchis spectabilis* (fl.)  
*Viburnum prunifolium*  
*Fagus grandifolia*  
*Smilax glauca*  
*Quercus falcata*  
*Senecio cf. pauperculus*  
*Parthenocissus quinquefolia*  
*Achillea millefolium*  
*Rubus cf. argutus*  
*Rubus idaeus*

*Fragaria americana*  
*Rumex crispus*  
*Veronica officinalis*  
*Agrimonia*  
*Vitis*  
*Hypericum hypericoides*  
*Viola rafinesquii*

White pine is on a gentle  
 west slope - several  
 scattered large trees  
 with a large number  
 of seedlings and saplings  
 around. some scattered  
 rather far into the  
 surrounding forest.  
 one of largest is over 2' dbh.  
 These large ones are scattered  
 along a small gully.



120 ~~1964~~ 1964 Virginia

April 26 Fernbrook Natural Area  
2 mi. Stony Point,  
Roanoke River

Mixed deciduous  
second-growth woods

45190

*Carex*

✓ 1

occasional

✓ 1

91 *Ranunculus*

rare

✓ 1

92 *Luzula*

occasional

✓ 1

93 *Hedyotis caerulea*

locally common

✓ 1

94 *Urnularia perfoliata*

common, occasional

large colonies

✓ 1

95 *Viola papilionacea* Pursh.

common

✓ 1

96 *Tipularia discolor*

rare

✓ 1

97 *Aplectrum hyemale*

occasional, locally common

✓ 1

98 *Ostrya virginiana* L.

rare

Albemarle Co.

121

small tufts

flowers yellow

small tufts

representing a colony in  
which 5-merous flowers  
~~are~~ and 3-merous flowers  
are occasional, usually  
on same plants with 4-merous ones,  
rhizomes slender, white,  
flowers yellow, pendent.

flowers purple

leaves deep purple beneath,  
plicate.

leaves purplish green  
with conspicuous white  
nerves.

small tree about 10 m. tall.  
bark shreddy-flaky.



May 2. Miami to Homestead  
via Old Cutler Rd. & Dixie Hwy.  
Several patches of  
pine-lands have been  
burned. The young  
seedlings look dead  
but apparently survive  
fire frequently 3-4 years,  
so seedlings must survive.  
Sabal and Serenoa are very  
fire resistant - send out  
leaves only a few days  
after burning. An  
area burned a year or so  
ago has an almost complete  
shrub layer of stemless  
palms. The fire is needed  
to preserve the character  
of the pine-lands.

Just s. of jct. with Dixie Hwy.  
apparently *Pluchea indica* and  
*P. odorata* - both along roadside.  
Not certain. Possibly *Baccharis*.  
*Albizia lebeck* seems to  
be naturalized.

Bulldozed pine-lands  
followed after cultivation  
grown up to a solid weed growth -  
*Chenopodium* sp. album  
*Amaranthus*  
*Lochner*  
*Bidens radiata*  
*Eupatorium* spp.  
ambrosia

succeeded  
by  
*Panicum*

One large block of pine-lands  
has been subject to  
controlled burning - site  
of wells for Key West water supply.

Land farmed for 3 years  
followed by 2-5 in 10 years.

~~Low grass~~  
Inside Everglades  
Nat. Park - saw grass  
everglades - have not  
been burned recently -  
shrubs appearing.

Where no burning for  
10-12 years a thick growth  
*Conocarpus* and *Metopium*  
Locally *Ilex*, *Chrysobalanus*.

Ground is pitted limestone  
with interstices filled  
with peat. If fire occurs  
when water table is down  
the peat burns out.

Pine seedlings have very  
thick bark toward base.  
Stem appears conical. Fire  
does not kill them unless  
too strong. Palmetto is  
surrounded by leaf bases,  
resists fire. Probably the  
amount of water absorbed  
has something to do with



The survival.

"Gati" holes are ~~not~~ depressions in limestone filled with water - sometimes 2' deep. May be open, surrounded by *Thalia*, or wooded with *Salix* and other wet-land hardwoods.

Where surface of pitted limestone is substantially higher, there are hammocks of different hardwood - *Lysitoma*, *Dodonaea*, etc. *Quercus*, *Myrica*.

Beyond "Rock-Ref" is low grassy area with scattered dwarf cypress 2-4 m. tall, apparently same age as clumps of much taller ones. There never seem to get much farther. This is practically sea-level. The taller patches are where there are pits filled with peat to 2 m. or so.

Where land rises to 0.5 m. ab. tropical hardwood hammock takes over. A few small binned

No obvious difference bet. where there is pin-land and hammock.

Vegetation pattern strongly reflects slight differences in elevation.

Many *Rhizophora* scattered over wide areas, about 1 m. tall. Here there is about 20 cm. of mud on ~~the~~ rock.

Where there is a dense clump of *Rhizophora* 2-3 m. tall, the mud, with some peat, is 1.5-2 m. deep. Some peat under this mud. Where the mud is very shallow, don't see mangrove.

Where even a tiny clump of mangrove there is a depression with peat.

Question is whether holes are necessary for survival of mangrove seedlings or whether mangroves desolve out the rock.

The entire area is covered by a mat of mud encrusted filamentous algae - this dry now and fragmented into 5-10 cm. pieces.

On right side of road 1 m. mangrove almost



continuous, on left,  
very scattered.

~~usually~~  
A little farther along  
they are more abundant  
even on left.

"Bay heads" a few hammocks  
without rock - patches  
of wood about 15-5 m tall  
with no depression  
in the rock beneath  
but with a mound  
of peat up to 70<sup>90</sup> cm ±  
above surface of road.

Here are *Paurantia*, *Persen*,  
*Magnolia* wing, *Clay*  
*cassin*, *Chrysobalanus*,  
*Myrsine*, *Myrica*,  
*Metopium*, ~~also~~ *Vatica*  
*rotundifolia*.

*Eleocharis aciculata* (little  
or no anthracium in  
young fronds.)

Epiphytic *Psittacanthus*,  
*Catopsis* and several  
*Thillandria* sp. *T. balbisiana*.

The whole surrounded  
by a fringe of mangrove  
that are much taller  
(up to 4 m) than the dwarf  
ones on the marl. This fringe  
is on the edge of the peat.

7 *Eleocharis*  
4 *Eleocharis*  
7 *Eleocharis*

Around this is a depression  
in the marl, perhaps  
dissolved out by acid seepage  
from the great accumulation.

Nine-While Bend - old  
borrow pit filled with  
water. In water is  
*Ruppia maritima* and  
*Najas maritima*.  
On shore *Bacopa monnina*,  
*Azadirachta*, *Conocarpus*,  
American egret, great  
blue heron, osprey.

Beyond this there is  
rather thick mangrove  
scrub 2-3 m tall.  
On left many patches  
of saw grass poking up  
right practically none.  
Then a ridge of peat  
covered by *Conocarpus*  
thicket, perpendicular  
to road.

Then area where  
Hurricane Donna killed  
*Rhizophora* and *Conocarpus*  
is replacing it.  
Pond filled with  
jelly-like peat, underlain  
by marl. No mangroves  
started yet.



Red, black & white mangroves killed where mud layer deposited on substratum by Hurr. Donna. Survives along road margin, on Indian mounds, etc. *Conocarpus* survived except in lower spot where they were killed, too. Craighead says that in November the mangrove root was rotted off to level of mud.

In areas where everything was killed a scattering of seedlings have now established themselves. After hurricane the seedlings were abundant but several dry years caused death of most of them. Locally some surviving. A lawn of *Paspalum* covers the entire area where the mangroves were destroyed.

At Flamingo are open areas, caused by charcoal burning, farming, etc. Hurricane Donna covered these with mud. *Conocarpus* coming up in quantity,

with *Salicornia*, *Distichlis*, etc.

In Florida Bay on inner shore birds & heron on the mud flats. Laughing gulls, red-wing blackbird, terns.

Strand plants on flat back of beach -  
*Heliotropium curassavicum*  
*Sporobolus domingensis*  
*Bidens pilosa*  
*Sesuvium portulacastrum*  
*Luarea*  
*Alternanthera*  
*Panicum* sp.  
*Salicornia*

Florida Bay - boat trip to keys. Merganser - flock of pelicans in channel. Avicennias along channel, fair size trees. Passed Joe Key Key - most of woody vegetation dead, some trees alive on periphery.

### Palm Key

Avicennias on beach ridge on south end. a few *Rhizophora*. Much turtle grass thrown up on beach ridge. In ridge of shell sand - not more than 20-30 cm above water. Auger pushed 4 1/2 ft without turning.



List of plants on  
Palmyra Key

*Ariceunia germinans*  
*Batis maritima*  
*Sesuvium portulacastrum*  
*Salicornia bigelovii*  
*Watteria indica*  
*Galactea apicata*  
*Crinum americanum*  
*Panicum virgatum*  
*Alternanthera*  
*Borrichia fruticosa*  
*Portulaca oleracea*  
*Randia aculeata?*  
*Melanthera*  
*Philoxerus mucronatus*  
*Panicum adspersum*  
*Quacda linearis*  
*Solanum elaeagnifolium*  
*Chloris petraea*  
*Commelina cf. elegans*  
*Atriplex pentandra*  
*Cyperus sp.*  
*Salicornia peruviana*  
*Spartina*  
*Setaria*  
*Distichlis?*  
*Maytenus phyllanthoides*  
*Sabal (stump)*  
*Limnistrachys <sup>castanea</sup> ~~spicata~~*  
*Limnistrachys cf. puberula*  
*Erigeron carolinianus*  
*Heliotropium paniculatum*  
*Sabal palmella*

Inner beach ridge well  
-covered by plants.  
Top 2 ft of firm black  
soil, then soft soupy  
gray mud with some shells.

Inner flat with *Suaeda*,  
*Salicornia*, *Batis*, etc. with  
spots of bare mud with  
no vegetation.

Here the top 2-3 ft. is very  
stiff mud, then soupy mud,  
at bottom (8 1/2-9 ft) a thin  
layer of peat, then rock.

A few scattered small  
*Ariceunia* on outer belt  
of this flat.

On most of this flat  
there is a thin layer of mud  
deposited by H. Donna.

In some areas, nearer  
periphery of flat, are stands  
of *Borrichia* with scattered  
small stiff bushes of *Randia*  
& *Maytenus*.

Locally stands of *Spartina*,  
stands of *Borrichia* and  
*Batis* are hard to go through.

The interior is normally  
a shallow lake, now dry  
because of abnormally dry  
year. Then no veg. in  
submerged part. Now  
closed scrub dwarf scrub or  
dwarf meadow.



Frank Key  
surrounded by a  
belt of mangrove -  
mostly dead.

Ground 2 inches high  
by *Conocarpus* grass  
& other hard-neck growth.  
A broad belt of this,  
rather open, much of  
it dead. A carpet of  
*Batis*, *Salicornia*, *Portulaca*  
etc.

Then a bare marsh  
flat with here and  
there a few scattered  
*Salicornia bigelovii* (Peters)  
(*granarum*)

An open belt of *Batis*  
with scattered  
dead or living small  
*Avicennia* 2-3m tall.

Only on e. side the  
entire belt of trees  
seems dead.

On s.w. end mangrove  
are dead except the row  
lining the outer beach.  
Here pelicans, roseate spoonbills,  
cormorants and (?) white ibis  
are roosting.

*Avicennia germinans*  
*Rhizophora mangle*  
*Conocarpus erecta*  
*Batis maritima*  
*Sesuvium portulacastrum*  
*Salicornia perennis*  
*Maytenus phyllanthoides*  
*Borrichia frutescens*  
*Quacua linearis*  
*Pectaria (large) macrocarpa*  
*Sporobolus*  
*Cyperus*  
*Atriplex*  
*Cenchrus myosuroides*  
*Rivina*  
*Metopium*  
*Alternanthera*  
*Panicum*  
*Laboul palmetto* (dead)  
*Euphorbia heterophylla*  
*Caesalpinia bonduca* (catpaw)  
*Laguncularia*  
*Salicornia bigelovii*  
*Capraia bipina*  
*Euphorbia heterophylla?*  
*Spartina*  
*Sporobolus virginicus*



## Anhinga Trail -

A huge new building and a stone wall around the pond at end of road. A new board-walk has been built, surrounding the place where the anhingas used to congregate. They have mostly left. In the ponds *Nuphar* sp. is abundant. *Panicum haematomum* and *Scirpus (laevigatus)* sp. (thought by Olga Pacheco to be new) in fairly deep water at bed. Alligators. Large terrapin. Bull frog.

Small J.K.

Vegetation and Insects on The Everglade Keys

Sci. Mo. 30:33-49, 1930.

Ginsburg, R. F. & Lovenshine, H. A.

The influence of marine bottom communities on the depositional environment of sediments.

Jour. Geol. 46:310-313, 1958.

May 3. Hammock on Jennings Estate on Miami Volite breaks off abruptly and thick mangrove extend seaward.

*Celtis laevigata*  
*Dalbergia strobilifera*  
*Pisonia aculeata*  
*Annona glabra*  
*Psychotria nervosa*  
*Bursera simaruba*  
*Zanthoxylum fagara*  
*Petiveria alliacea*  
*Bruguiera dendroidea*  
*Pouteria foetidissima*  
*Piscidia*  
*Coccoloba diversifolia*  
*Ficus aurea*  
*Nephrolepis exaltata*  
*Ardisia racemosa*  
*Myrsine*

An old spring or creek mouth, now dried up by lowered water table shows the best example of cross-bedding I have ever seen, in Miami oolite.



May 2 - about 12 mi. n. of  
Flamingo

45199

In "bay head", a type  
of hammock with deep peat.  
*Psilotum nudum* (L.) Beauv.  
rare, on fallen tree trunks

May 2 - Nine Mile Bend,

~~7~~ 9 mi. n. of Flamingo

in small lake in borrow  
pit dug in limestone,  
perhaps slightly brackish.

45200

*Najas marina* L.

occasional, washed up

2

01

*Ruppia maritima* L.

common, washed up and  
also rooted in shallow water,

1

02

*Bacopa monnieri*

common on shore of

May 2 Royal Palm

Anhinga Trail

3

03

*Panicum haematomum*

common in ponds to 1 m. or  
more deep, rooted on bottom, emergent

May 2 Flamingo

04

*Sporobolus domingensis*  
common on sand flat  
back of beach

prostrate, forming a  
loose mat; flowers lavender.

rhizome hollow; ~~erect~~  
panicle erect, branches  
closely appressed.

Tufts, culms ascending.



May 2 - Palm Key, in Florida Bay  
on fine compact marl soil  
in full sun

45205

*Randia aculeata* L.

06

locally common

07

*Maytenus phyllanthoides*  
occasional

May 2 - Frank Key

08

*Halophila*

floating in shallow water.

09

*Euphorbia* cf. *cyathophora*

occasional in open

area dominated by *Batis*,  
on marl soil in interior

10

*Capraia biflora*

rare

11

*Sporobolus virginicus*?

very local

12

(blue green)

abundant on bare bottom of  
desiccated marl pond

May 3 - Miami, Key Biscayne.

13

*Genipa clusiaefolia*

rare in strand scrub  
on sand flat

14

*Ambristylis cymosa*

occasional on sand flat

shrub 1 m. tall; flowers  
white, fragrant.

shrub 1 m. tall; seeds  
with red fleshy aril,  
erect in capsule.

erect, lactiferous, bracts  
scarlet at base.

sterile.

shrub 1.8 m tall, flowers  
white, fragrant, ~~corolla~~ corolla  
strongly salverform; fruit  
green.



"nanpore rocks" - a platform, almost horizontal. Top layer is a mat of roots, up to several inches diam. entraping fine sand & silt. Then a 3 dimensional network of roots casting forming a layer a few ~~cm~~ cm to several dm thick. Said to be in places several rock layers. In places an apparently homogeneous fine sand, slightly perceptible difference in hardness. This exposed to gentle waves comes out as this reticulum which then apparently case-hardens preserving the whole thing. Mats of ~~aguminate~~ roots exposed by wave washing show more or less the same pattern though less anastomosing.



142

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1 200



University (2)	to: 300 sheets	Univ 3000-1000 sheets
Agriculture Dept.	CSIR 600 sheets	
Forest Dept.		
Forest Res. Inst. Min. Forest Prod. Div.		
CSIR		
Natural Products Res		



Colleges where botany is taught

Interested people

Industries using  
plant materials

Indigenous drug users

No of staff  
equipment



University (2)  
Agriculture Dept.

Forest Dept.  
Forest Res. Inst.  
Minor Forest Prod. Div.

CSIR

Natural Products Res.

Tot. 300 sheets

CSIR 600 sheets

Univ. 800-1000 sheets

Colleges where botany is taught

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